The Temperatures of the Attainable Superheat of Some Thermally Unstable Liquids

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The paper gives the results of measuring the temperatures of the attainable superheat of some liquids that are thermally unstable at these temperatures. The liquids investigated are the following: n-alkanes C_nH_{2n+2} (n = 19-36), 1-alkanols $C_nH_{2n+1}OH$ (n=13-22), alk-1-enes C_nH_{2n} (n=13-20), polyethene glycols $H(OCH_2CH_2)_nOH$ (n=1-13.2), some methylphenylsiloxanes, aqueous solutions of hydrogen peroxide, mixtures (n-alkane + isoprene rubber) and others. The method of heating a thin wire probe placed into a liquid under study with electric-current pulses has been used. The length of pulses is from 10^{-5} to 10^{-3} s, which corresponds to the heating rate of 10^5 - 10^8 K/s.

The experiments have shown that, as a rule, the longer is the pulse length, the lower is the temperature of the attainable superheat at a given pressure, and the higher is the critical pressure of the system (initial liquid + decomposition products). These facts are explained by the decomposition of the liquid and saturation of it with low-molar-mass products.

The influence of a chemical reaction in the liquid phase on the temperature of the attainable superheat has been considered. In particular, it has been shown that boiling initiated by an elementary act of an exothermic chemical reaction is possible only at negative pressures. The method of calculating the temperature of the attainable superheat of thermally unstable liquids under conditions of quick heating has been developed. The input parameters required by the method are as follows: the critical pressure, the critical temperature, and the acentric factor of the liquid, the heating rate, the activation energy, the rate premultiplier, and the order of the reaction of decomposition. The calculated temperatures of the attainable superheat are in good agreement with the experimental ones.